

# Ambient Water Quality Criteria for Bacteria

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Objectives, to provide:

An understanding of EPA's current §304(a) water quality criteria (WQC) for bacteria

Information regarding the adoption and implementation of the WQC

An update on EPA's development of new/revised recreational WQC

# Why Do We Need Bacteria Criteria?

- ❖ Bacteria criteria help protect against disease caused by fecal pathogens from recreational exposure to contaminated water
- ❖ 37% (1,362) of coastal and Great Lakes beaches were closed or had an advisory posted for at least one day in 2010
- ❖ CDC continues to document cases of waterborne disease outbreaks in their 2011 "Surveillance" Report (MMWR, CDC 2011)

# Indicators

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- ❖ EPA's recommended bacteria water quality criteria (WQC) are for indicator organisms (indicating fecal contamination)
  - ❖ Pathogens are disease-causing microorganisms that include viruses, protozoa, and bacteria
  - ❖ Monitoring for the many fecal pathogens is difficult and costly so we monitor for fecal indicators instead

# Rec Criteria History

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- ❖ Federal bacteria criteria recommendations first made in 1968
  - Based on PHS studies, conducted 1948-1950
    - Studies measured total coliforms
  - Recommended a limit of Fecal coliforms 200 CFUs/100 ml
  
- ❖ In 1972 EPA initiated a series of multiyear, comprehensive epidemiological studies at marine and fresh water bathing beaches

# Results of Studies in the 70s/80s

- ❖ Of the indicators measured during the studies, *E. coli* and enterococci showed strongest correlation to swimming-associated gastroenteritis
  - *E. coli* and enterococci in fresh waters
  - Enterococci in marine waters
- ❖ Results described in detail in the 1986 (current) Bacteria Criteria document

# The Use of EPA's Recommended Criteria

❖ The criteria are used in two different, yet related ways:

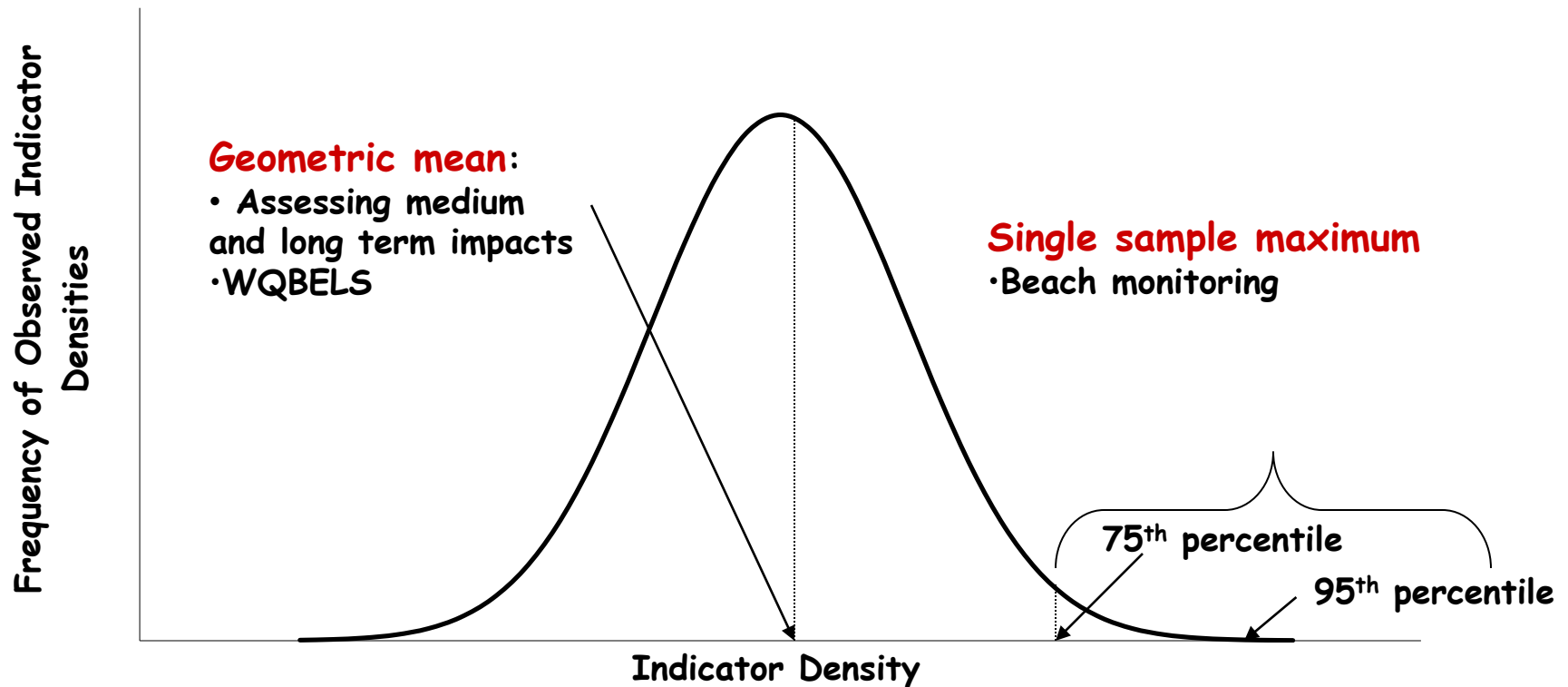
- Protection of water bodies designated for recreational uses in state and tribal WQS
  - Used to derive permit limits, make listing decisions, and develop TMDLs
- Beach monitoring and notification programs
  - Protect public health
  - Aid in determining when to issue advisories or close beaches

# Bacteria Criteria in Water Quality Standards

- ❖ States adopt bacteria criteria to protect waters designated for recreation
  - Primary contact recreation
    - Seasonal and intermittent uses
  - Secondary contact recreation
- ❖ States designate the majority of waters for primary contact

# Components of EPA's Criteria

- ❖ *E. coli* and enterococci criteria have two components:
  - Geometric mean
  - Single Sample Maximum or Upper Percentile Value





# Primary Contact Recreation

## ❖ Current Fresh Water Criteria Recommendations

### • Enterococci

Risk Level (% of swimmers)	Geometric Mean Density (per 100 mL)	Single Sample Maximum Allowable Density (per 100 mL)			
		75 <sup>th</sup> percentile	82 <sup>nd</sup> percentile	90 <sup>th</sup> percentile	95 <sup>th</sup> percentile
0.8	33	62	79	107	151

### • *E. Coli*

Risk Level (% of swimmers)	Geometric Mean Density (per 100 mL)	Single Sample Maximum Allowable Density (per 100 mL)			
		75 <sup>th</sup> percentile	82 <sup>nd</sup> percentile	90 <sup>th</sup> percentile	95 <sup>th</sup> percentile
0.8	126	236	299	409	576

# Primary Contact Recreation

## ❖ Current Marine Water Criteria - Enterococci

Risk Level (% of swimmers)	Geometric Mean Density (per 100 mL)	Single Sample Maximum Allowable Density (per 100 mL)			
		75 <sup>th</sup> percentile	82 <sup>nd</sup> percentile	90 <sup>th</sup> percentile	95 <sup>th</sup> percentile
1.9	35	104	158	276	501


# What is the BEACH Act?

- ❖ 2000 Amendment to the Clean Water Act, for coastal and Great Lakes recreation waters
  - Applies to 35 States

- ❖ Key EPA requirements

- Ensure state adoption of coastal recreation water quality criteria
- Conduct research on pathogen indicators in coastal recreation waters and develop rapid methods
- Publish performance criteria for monitoring and notification
- Provide development and implementation grants to state, tribal and local authorities

# The BEACH ACT Regulation

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- ❖ EPA promulgated on November 16, 2004
  - ❖ Best source of information on EPA's interpretation of the criteria for both coastal recreation waters and inland waters
  - ❖ Preamble and technical fact sheets include some implementation language

# Key Implementation Points: Risk Levels

## ❖ Risk Levels

- EPA data support:
  - up to 19 illnesses/1000 swimmers in marine water
  - up to 10 illnesses/1000 swimmers in freshwater
- Higher illnesses rates for protection of primary contact uses must be supported by data
- No UAA required to move between risk levels of 8 – 10 illnesses/1000 swimmers for a freshwater body

# Key Implementation Points: Geo Mean and SSM



- ❖ Geometric mean is value most closely linked to the illness rates
- ❖ Single Sample Maximum was not intended to be used as a “not to be exceeded” value

# Geo Mean and SSM in BEACH Act Waters

- ❖ Must have both Geo Mean and SSM for all waters designated for primary contact rec
- ❖ Must use SSM for beach closure and advisory programs
- ❖ States have flexibility to:
  - Adopt some or all of the SSMs
  - Describe the applicability of the SSM for the various CWA purposes in their standards
- ❖ Do not have situations where neither Geo Mean nor SSM apply
  - Federal promulgation does not include minimum sample size requirements for calculating the Geo Mean.

# Geo Mean and SSM in Inland Waters

- ❖ For 'inland waters' (in other words, waters not covered by the BEACH Act), EPA recommends the same criteria as required for BEACH states under the Beach regulation.
- ❖ States/tribes with inland waters are encouraged to follow the same steps as in the previous slide.



# Uses of the SSM

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- ❖ Beach advisory and closure programs
  - ❖ Waterbody assessment
    - Small datasets
    - When states collect “insufficient” (as defined by their regs) data to reliably average and compare to the geometric mean
    - Sources of short-term spikes (CSOs)

EPA encourages states to clarify in their water quality standards how they will use the SSM component.

# Key Implementation Points: Non-Human Sources

❖ Non-Human source exclusions to the criteria can be allowed when:

- The sources are only from non-human sources (supported by sanitary surveys/watershed characterization studies)

AND

- Those non-human sources are shown to pose no risk to human health (i.e., through an epi study)

States may use existing epi data in lieu of conducting their own studies

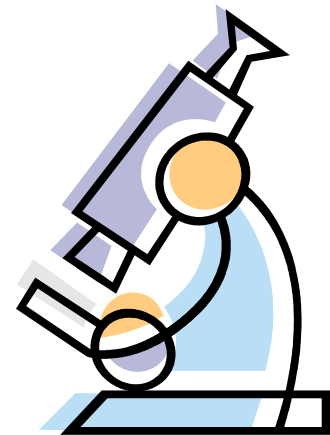
# EPA's New/Revised Criteria Objective

## ❖ Why?

- Beach Act requires new/revised criteria
- Incorporate new science—over 20 years since 1986 criteria; CWA requires updates “from time to time”
- Improve scientific foundation and implementation based on what we've learned over the past 20 plus years
- Ease implementation for BEACH Act states: no double standards
- Makes providing protection for downstream rec waters easier
- 2012 is Consent Decree deadline

# Major Research Areas

- ❖ Epidemiology Studies and Quantitative Microbial Risk Assessment (QMRA)
- ❖ Site Characterization
- ❖ Indicators/Methods Development and Validation
- ❖ Modeling
- ❖ Application to:
  - >Coastal (marine) waters
  - >Great Lakes
  - >Inland Waters- rivers, streams, lakes



# Revising the Rec Criteria

- ❖ BEACH Act also required EPA to publish new/revised criteria for coastal recreational waters
- ❖ EPA will release a draft revised Rec Criteria for scientific views from the public in early 2012
- ❖ The final revised Rec Criteria will be signed no later than October 15 2012.
- ❖ The revised RWQC will be based on new epi data to assure protection of public health

# Expert and Stakeholder Input on Revised RWQC

- ❖ March 2007 (Warrenton, VA) – Experts workshop
- ❖ February 2008 (Washington, D.C.)
  - Purpose, content & status of *Critical Path Science Plan*
- ❖ February 2009 Inland Waters Workshop
- ❖ October 2009 (Chicago, IL )
  - Status update on research
- ❖ March 2010 (Webinar) – recap of October 2009 meeting
- ❖ October 2010 (Webinar)
  - Framing main issues associated with the new criteria
- ❖ June 2011 (New Orleans, LA)
  - Input on evaluation and synthesis of research and development of options for structure of the new criteria
- ❖ September 2011 (Webinar) – recap of the June meeting
- ❖ September 2011 (Washington) – Scientific Peer Review
- ❖ November 2011 (Atlanta, GA) Expert Workshop on wildlife (non-human) sources of fecal contamination

# Current Thinking on the Draft RWQC

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- ❖ Recommend 304(a) criteria that apply to all waters (not just the BEACH states, territories and tribes)
    - Encourages consistency, as waters flow between states
  
  - ❖ Derive criteria based on the NEEAR research at POTW-impacted sites
    - Consistent with 1986 criteria values
    - Aim to carry forward into new criteria level of water quality protection afforded by current criteria recommendations
  
  - ❖ Allow for all states to take advantage of the newer science, for example: qPCR tool and predictive modeling

# Current Thinking on the Draft RWQC (2)

- ❖ Recommend culture methods for *Enterococcus* and *E.coli* in freshwaters, and *Enterococcus* in marine waters
- ❖ Clarify the expression of criteria construct
  - Maintain Geometric Mean and something akin to SSM (STV)
  - Eliminate “use intensity” risk range
- ❖ Provide tools for site-specific criteria derivation (QMRA with sanitary survey) and other flexibilities
  - Science does not permit us to recommend different, nationally applicable criteria values for different sources (e.g., gulls).
  - Predictive models as tool to enhance implementation of criteria, particularly for beach programs



# Current Thinking on the Draft RWQC (3)

## ❖ Provide tools for rapid analysis

- Enterococcus qPCR method in freshwater and marine waters for beach closure notification. Faster approach to measuring fecal indicator bacteria
- Predictive modeling

# For More Information


## ❖ EPA's Beach and Rec Criteria Web Pages

- <http://water.epa.gov/type/oceb/beaches/index.cfm>
  - BEACH Act text
  - Grants information
  - Beach Guidance Document
  - Local beach information
- <http://water.epa.gov/lawsregs/lawsguidance/beachrules/bacteria-rule.cfm>
  - BEACH Act rule
    - Technical fact sheets
- <http://water.epa.gov/scitech/swguidance/standards/criteria/health/recreation/index.cfm>
  - Experts Scientific Workshop Report and Executive Summary
  - Critical Path Science Plan
  - Consent Decree & Settlement Agreement Documents
  - Stakeholder Meeting/Workshop agendas and summaries
  - Research Reports completed in 2010

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# Take Home Messages

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- ❖ EPA's current §304(a) bacteria criteria are for *E. coli* and enterococci
  - ❖ When using the '86 bacteria criteria, states and tribes have flexibility;
    - To make appropriate risk-based decisions
    - In using the single sample maximum component of the criteria
  - ❖ EPA is developing new/revised criteria for publication in 2012